

THORACIC CAVITY

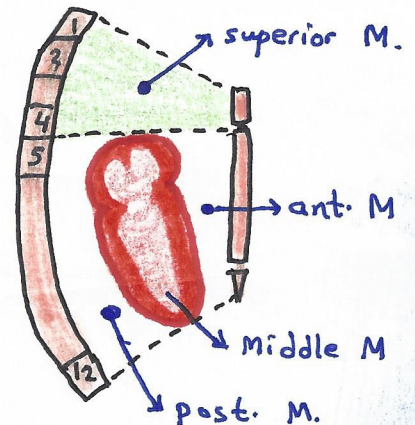
- The thoracic cavity is completely filled laterally by the lungs (w̄ surrounded by pleura).
- The space between the pleural ^{sacs} in the centre of thoracic cavity is the Mediastinum.

MEDIASTINUM

- Space between two pleural sacs, it is mobile partition

* Boundaries :-

- Superior :- thoracic inlet & neck root.
- inferior :- Diaphragm (thoracic outlet)
- anterior :- sternum.
- Posterior :- the 12 thoracic vertebrae.
- lateral :- pleura (mediastinal pleura)



* Divisions :-

- Subdivided into ① Superior mediastinum :-
above level of the sternal angle.

② Inferior mediastinum :-

below sternal angle & divided into

- A Anterior mediastinum :- front of heart & pericard.
- B Middle " :- occupied by heart & pericard.
- C Posterior " :- behind heart & pericard.

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① Superior mediastinum :-

- Boundaries :-
- above :- thoracic inlet.
 - Below :- line passing through ^{sternal} ~~thoracic~~ angle
 - anterior :- Manubrium sterni
 - posterior :- upper 4 thoracic vertebrae.
 - lateral (sides) :- mediastinal pleura & lung.

• Contents :- (27)

- ① - sternothyroid, sternohyoid & longus colli muscles.
- ② - Trachea, esophagus & thymus gland (remnant)
- ③ - Aortic arch & its branches → Brachiocephalic artery
 - Lt common carotid
 - Lt subclavian artery,
- ④ - Superior vena cava & tributaries →
 - Rt brachiocephalic vein
 - Lt " " " (Lt B.C)
 - (Lt superior intercostal vein) ↑
drains into Lt B.C.
- ⑤ - Vagus (Rt & Lt), phrenic (Rt & Lt) & Lt recurrent laryngeal N.
- ⑥ - Cardiac branches of
 - a - 2 vagus nerves.
 - b - 2 recurrent laryngeal nerves.
 - c - 2 symp. trunks (3x2 = 6 branches)
- ⑦ - Lymph nodes include :-
 - a - Brachiocephalic LN.
 - b - superior tracheo-bronchial.
 - c - Parasternal LN.
- ⑧ - Thoracic duct.

* Structures passing through inlet are :- (20)

- ① - sternothyroid, sternohyoid & longus colli muscles
- ② - Trachea, esophagus, thymus
- ③ - Rt & Lt brachiocephalic vein & aortic arch branches ←
 - LCCA
 - LSC
 - BC
- ④ - vagus nerve, phrenic N. & Lt recurrent L. N.
- ⑤ - thoracic duct. , inf. thyroid vein
- ⑥ - apex of lungs & cervical pleura

② Inferior mediastinum

① Anterior mediastinum :- (6)

- Boundaries :- front :- body of sternum.
behind :- Pericardium.
- Contents :- ① - superior & inf. sternopericardial ligaments
② - thymus gland. & fat.
③ - 2-3 lymph nodes.
④ - internal thoracic vessels branches.

② Middle mediastinum :- (18)

- Contents :- ① heart & pericardium
② Ascending aorta.
③ Pulmonary trunk
④ S.V.C (lower $\frac{1}{2}$)
⑤ I.V.C (uppermost part)
⑥ pulmonary vein ④ } inside pericardium.
- ⑦ tracheal bifurcation into main bronchi
⑧ Rt & Lt pulmonary arteries
⑨ Rt & Lt phrenic nerves
⑩ deep cardiac plexus
⑪ tracheo-bronchial lymph nodes } outside pericardium.

③ Posterior mediastinum :-

- Boundaries :- - front :- pericardium & upper surface of diaphragm
- behind :- from 5th to 12th thoracic vertebrae.

• Contents of post. mediastinum :- (19)

- ①- esophagus.
- ②- descending thoracic aorta.
- ③- azygos, superior & inferior hemiazygos
- ④- Vagus nerve (Rt & Lt) „
- ⑤- sympathetic trunk (Rt & Lt).
- ⑥- Greater splanchnic nerve (Rt & Lt).
- ⑦- Lesser „ „ „ „ .
- ⑧- Lowest „ „ „ „ .
- ⑨- post. mediastinal lymph nodes.
- ⑩- thoracic duct.

THE PLEURA

* Definition :-

- It is a thin serous membrane which covers lung & lines thoracic wall.

* Subdivisions of pleura :-

(A) Visceral pleura :-

- covers the lung except its root.

(B) Parietal pleura :-

- lines inner surface of chest wall, can

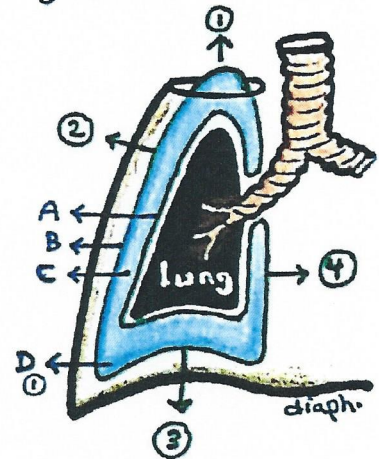
- It has the following parts :-

① **Cervical part** :- bulging up through thoracic inlet (1 inch above medial $\frac{1}{3}$ of clavicle).

② **Costal pleura** :- lining the ribs, intercostal spaces & costal cartilages (also sides of vertebral bodies & back of sternum).

③ **Diaphragmatic pleura** :- covers upper surface of diaphragm.

④ **Mediastinal pleura** :- covers the sides of mediastinum.



(C) Pleural cavity :-

pressure inside it always -ve to keep lung inflated

- slit like space between visceral & parietal pleurae.

- contains thin film of fluid to prevent friction between V. & P. pleurae

(D) Pleural recesses :-

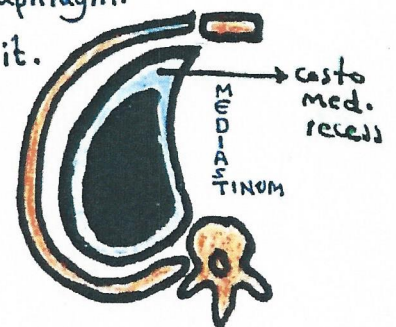
- narrow spaces ^{inside Pleural cavity} which are not occupied by lung except in full inspiration.

① **Costodiaphragmatic recess** :- between thoracic wall & diaphragm.

- during full inspiration, lower border of lung extend into it.

② **Costo-mediastinal recess** :- between thoracic wall & mediastinum (along ant. border of pleura).

- during full inspiration the ant. border of lung extends into this recess.



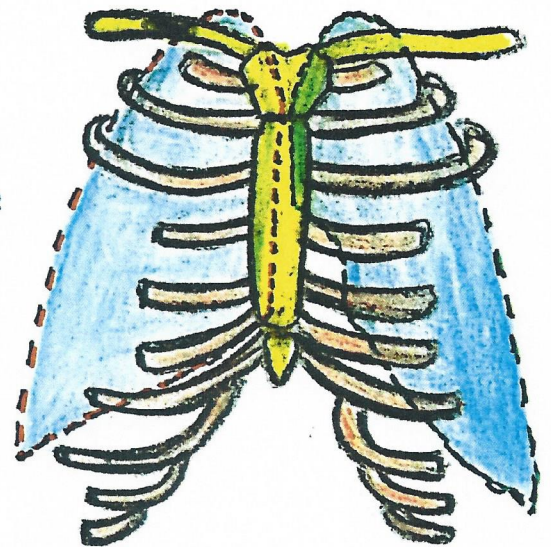
Nerve supply of pleura :-

- (A) visceral pleura :- (splanchnopleuric mesoderm) :- by autonomic nerve plexuses
 — sensitive only to stretch ↳ from pulmonary plexus
- (B) Parietal pleura :- (somatopleuric mesoderm) :- as follow :-
- 1- cervical pleura → by 1st intercostal nerve (T₁)
 - 2- costal pleura → segmentally by intercostal nerves.
 - 3- mediastinal → by phrenic nerves.
 - 4- diaphragmatic → by phrenic & lower ⁶ thoracic nerves.
- Parietal pleura is sensitive to pain, touch, temp. & pressure.

•• NB:- Visceral pleura is supplied by bronchial vessels.
 Parietal " " " " intercostal & internal ^(mammary) thoracic vessels

Surface anatomy of pleura :-

"parietal"
pleura



(A) apex (cervical) pleura :-

- curved line (convex upward) about 1 inch above medial 1/3 of clavicle.

(B) Anterior border :-

- ① Rt pleura → line start from sternoclav. joint passing downward & medially till middle of sternal angle then vertically downward till level of 6th costal cartilage where it ends.
- ② Lt pleura → line start from sternoclav. joint → downward & medial till middle of sternal angle → vertically downward till 4th costal cartilage → then curved line till 6th costal cartilage where it ends.

(C) Inferior border :-

- Line from 6th costal cart. $\xrightarrow{\text{to}}$ 8th rib midclavicular line $\xrightarrow{\text{to}}$ 10th rib in the midaxillary line $\xrightarrow{\text{to}}$ 12th rib posteriorly.

(D) Posterior border :-

- Line extends vertically from end of apex downward close to 12th thoracic spine. (along side the vertebral column).

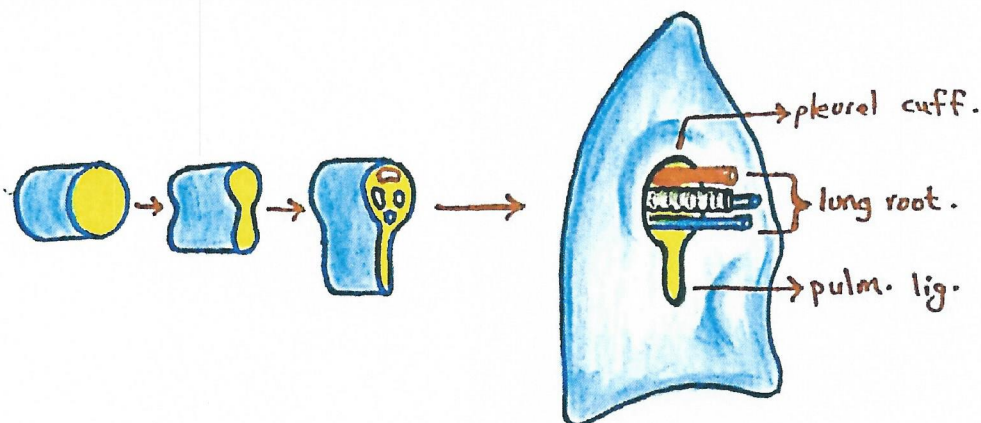
NB: ① The parietal & visceral pleurae are continuous with one another by **pleural cuff**; surrounding the **lung roots** (structures that enter & leave hilum of lung called lung root) (hilum of lung is a depression on medial (mediastinal) surface of lung)

② **Pulmonary lig.** :-

- is a loose fold hangs down from the pleural cuff.
- allows movement of lung root up & down. (vessels & bronchi).

* **Applied anatomy of pleurae** :-

- pleuritis (Pleurisy) :- inflammation of pleura.
- pleural adhesions :- adhesions (binding) of parietal & visceral pl.
- pleural effusion (hydrothorax) :- ↑ serous fluid in pleural cavity.
- Pneumothorax :- air accumulation inside pleural cavity.
- Haemothorax :- blood " " " " -
- Pyothorax (empyema) :- Pus " " " " -
- Hemo-pneumothorax :- blood & air " " " " -
- pyo-pneumothorax :- pus & air " " " " -
- Hydro-pneumothorax :- serous fluid & air " " " " -



THE LUNGS

- The lungs are the organs of exchange of gases between blood & atmospheric air.
- Each lung looks like a half a cone with an apex, base, 2 surfaces and 3 borders

Apex :- "rounded"

- projects upwards through the thoracic inlet extending 1 inch behind & above the medial 1/3 of clavicle.

Base :- "diaphragmatic surface"

- concave, sits on diaphragmatic cupula.

Surfaces :-

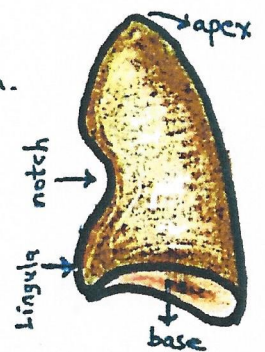
- ① **Costal surface** :- convex, related to ribs & intercostal spaces.
- ② **Medial (mediastinal) surface** :- concave, related to pericardium & mediastinal structures
 - the hilum of lung present about middle of this surface.
hilum gives passage for lung root.

Borders :-

- ① **Ant. border** :- thin, overlaps heart, in Lt lung has a cardiac notch and lingula (tongue like process).
- ② **Post. border** :- thick ^{rounded} ↑, lies beside the vertebral column.
- ③ **Inf. border** :- sharp, thin, forms boundary of base of the lung.

*** Surface anatomy of root of lung :-**

- Lies opposite the 5th, 6th & 7th thoracic vertebrae.
- the root of right lung is 1cm above that of Lt lung.



Lobes & fissures of lung :-

* Right lung :-

- slightly larger, wider, shorter due to liver.
- Divided by oblique & horizontal fissures into 3 lobes
 - upper
 - middle
 - lower

- Oblique fissure :-

- runs from inferior border upward & backward across medial & costal surfaces till it cuts post. border 2.5 inches below apex.
- It separates the middle & upper lobes from inferior lobe

• horizontal fissure ::

- runs horizontally across costal surface at level of 4th costal cartilage to meet oblique fissure in midaxillary line.

- Middle lobe:-

- small triangular lobe between horizontal & oblique fissure.

* Left lung:-

- divided by oblique fissure into 2 lobes ↗ lower ↘ upper
- no horizontal fissure, no middle lobe.
- in anterior border has lingula and cardiac notch.

* upper (superior) lobe :- above & ant. to oblique fissure.

* lower (inferior) lobe :- below & behind to " " .

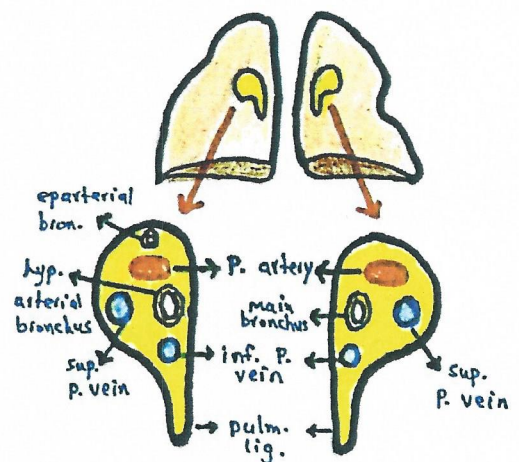
Root of the lung :-

- ① Pulm. artery:- occupies upper part of hilum.
- ② sup. pulm. vein:- the most anterior in " .
- ③ inf. " ":- " " inferior " " .
- ④ Bronchus (main):- " " posterior " " .

[the Rt main bronchus divided before entering into
-eparterial (above artery) & hyparterial (below artery)]

(5) minor structures as :-

- a - lymph vessels & nodes (Bronchopulmonary LN).
- b - pulmonary plexuses of nerves (ant. & post plexuses). "symp. & parasymp."
- c - Bronchial vessels (~~the~~ lung has 2 bronchial arteries while ~~the~~ one has one artery).



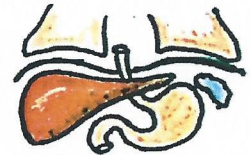
Relations of lungs :-

* Relations of apex :-

- Front :- 1st costal cartilage (separated by int. thoracic artery). -
- grooved anteriorly by subclavian artery.
- Behind :- neck of 1st rib (which separated by ① ventral ramus of T₁ nerve "intercostal N.", ② sup. intercostal artery ③ symp. trunk) "cervicothoracic gang."
↳ inf. cervical sym. ganglion

* Relations of base :-

- Rt lung base :- separated by Rt cupula of diaphragm from Rt lobe of liver
- Lt lung base :- " " " Lt " from Lt lobe of liver, spleen and fundus of stomach.



* Mediastinal surface (Medial relation) :-

	Rt lung mediastinum	Lt lung
above the hilum	① groove for <u>arch</u> of azygos immediately above hilum. ② 3 vertical grooves above arch of azygos (from before backward): • groove for <u>Rt innominate vein</u> & <u>Rt phrenic N.</u> • groove for <u>trachea</u> & <u>Rt vagus</u> • groove for <u>esophagus</u>	① groove for <u>arch</u> of aorta immediate above hilum (deeper) ② 3 vertical grooves above arch of aorta (from before backward): • groove for <u>Lt c. carotid a.</u> • " " <u>Lt subclavian a.</u> • " " <u>esophagus</u> } Lt phrenic & Lt vagus in between 2 grooves.
- in front of the hilum & pul. lig.	① Cardiac impression related to <u>Rt atrium</u> & <u>Rt phrenic</u> ② groove for <u>SVC</u> & <u>Rt phrenic N.</u> ③ " " <u>IVC</u> & <u>Rt phrenic N.</u>	• Cardiac impression (wide & deep) related to <u>Lt ventricle</u> & <u>Lt phrenic</u>
- behind the hilum	- groove for <u>esophagus</u> & the <u>azygos vein</u> behind it.	- groove for <u>descending aorta</u> & (the <u>esophagus</u> in the lower part)

• How to Know Rt from Lt lung :-

- Apex above, base below, ant. border sharp, post. border rounded.
- hilum medial.

Broncho-Pulmonary segments :-

A) Rt lung :- (10 segments):-

- upper (superior) lobe → 1) apical, 2) anterior, 3) posterior
- Middle lobe → 4) Medial 5) lateral.
- lower (inferior) lobe → 6) superior (apical) 7) medial basal
8) lateral basal 9) Ant. basal 10) Post. basal.

B) Lt lung :- (8 segments):-

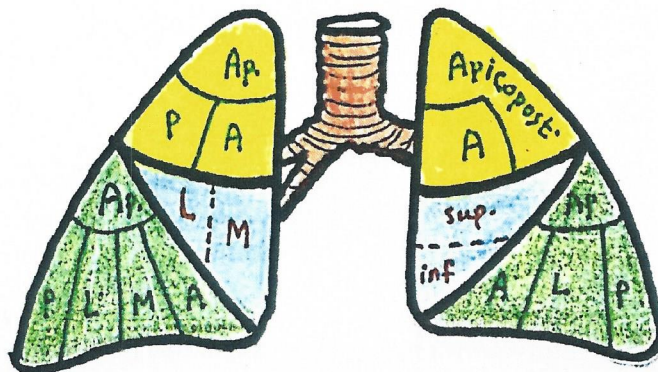
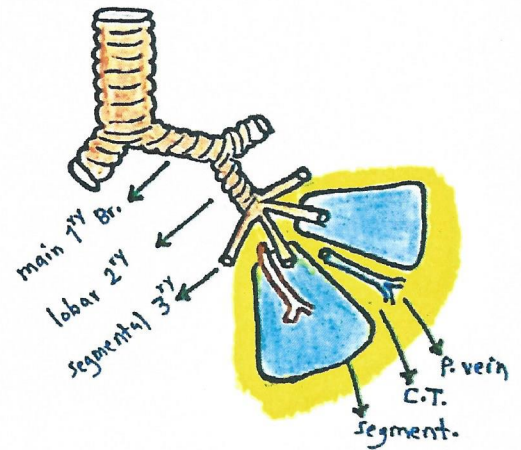
- upper lobe → 1) apicoposterior 2) anterior
3) superior lingual 4) inferior lingual.
- lower lobe → 5) superior (apical) 6) lateral basal [medial commonly absent]
7) anterior basal 8) posterior basal

* Notes :-

- The Broncho-pulmonary segment is the anatomical, functional and surgical units of the lungs.
- each lobar (2nd) bronchus passes to lobe to give segmental (3rd) bronchi.

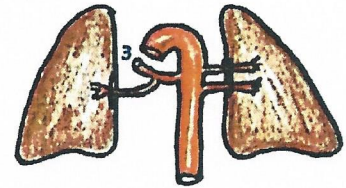
* Characters of a broncho-P. segment :-

- 1- Subdivision of lung lobe.
- 2- pyramidal in shape.
- 3- surrounded by conn. tissue (C-T).
- 4- Has :- segmental bronchus, seg. artery, lymph vessels & autonomic nerves.
- 5- the segmental vein lies in C-T between adjacent segments.
- 6- diseased segment can be removed surgically as it is structural unit.



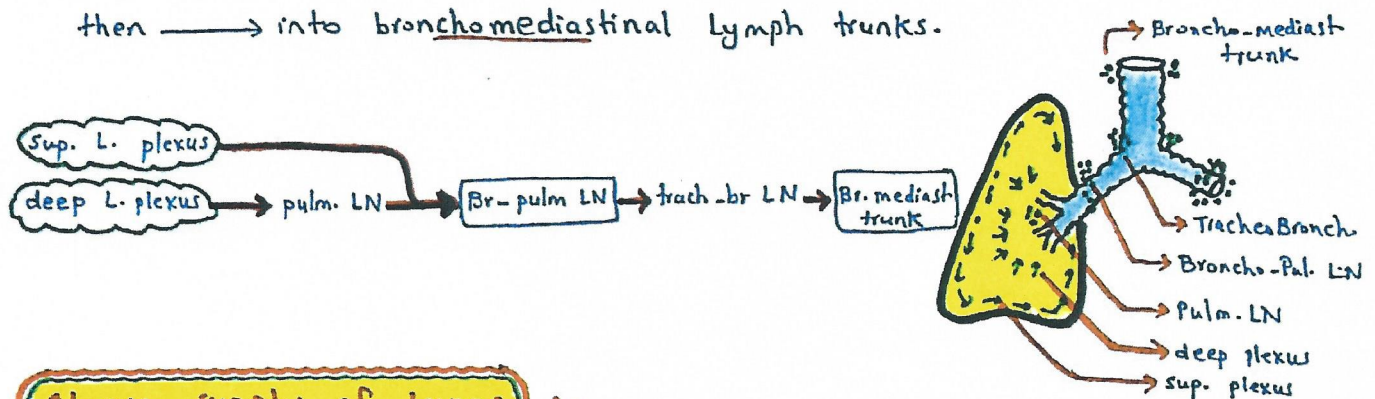
Blood supply of lungs :-

- Rt lung:- supplied by one bronchial artery arising from 3rd Rt. post. intercostal artery (or from upper Lt bronchial a.).
 - the Rt bronchial veins drain into azygos vein.
- Lt lung:- supplied by two bronchial arteries from descending thoracic aorta
 - the Lt bronchial veins drain into sup. hemiazygos vein



Lymphatic drainage :-

- ① superficial (subpleural) plexus of lymph :-
 - lies under visceral pleura, enter bronchopulmonary L-nodes.
- ② deep lymph plexus:-
 - drain into → intrapulmonary LN (inside lung) → to brncho-pulm. LN (in hilum) → into tracheobronchial LN (in carina "tracheal bifurcation") then → into brnchomediastinal lymph trunks.



Nerve supply of Lungs :-

- derived from the ant. & post. pulmonary plexuses. (at hilum).
 - ①-sympathetic fibers (vasoconstrictor & bronchodilator) :-
 - from the 2nd, 3rd & 4th ganglia of thoracic sympathetic chain.
 - ② parasympathetic fibers (vasodilator & bronchoconstrictor) :-
 - from the vagus nerve.
- NB** → afferent impulses from lung reach CNS in both symp. & paras. fibers (afferent send sensation of stretch).

Surface anatomy of lung :- see page 2 (thorax II)

- ① **Apex of lung**:- same as surface anatomy of cervical pleura (1 inch above medial $\frac{1}{3}$ of clavicle).
- ② **Anterior border**:- same as surface anatomy of Rt & Lt pleura (with cardiac notch in Lt lung as Lt pleura)
- ③ **Lower border**:- represented by curved line extending from 6th costal cartilage crossing :-
 - the 6th rib in midclavicular line.
 - the 8th " " mid axillary line.
 - the 10th ^{rib} thoracic spine posteriorly
- ④ **Posterior border**:- same as Rt & Lt lungs → extending vertically upward alongside vertebral column from 10th thoracic vertebra spine up to apex above.
- ⑤ **oblique fissure**:- extend from root of spine of scapula obliquely downward, laterally & anteriorly following course of 6th rib to 6th costochondral junction
- ⑥ **transverse fissure**:- horizontally along 4th costal cartilage to meet the oblique fissure in midaxillary line.

* Differences between Rt & Lt lungs :-

	Right lung	Left lung
Size	shorter, wider & larger.	longer, narrower & smaller
Ant. border	straight, no lingula.	has cardiac notch & lingula.
fissures	2 → oblique & horizontal	1 fissure → oblique.
lobes	3 → upper, middle & lower	2 → upper & lower.
segments	10 segments (bronchopulmonary seg.)	8 segments usually.
hilum	<u>2</u> bronchi (ep. & hyp), <u>1</u> bronchial artery	1 bronchus & 2 bronchial a.

PERICARDIUM

* Definition :-

- Fibroserous sac enclosing the heart & root of great vessels.
- present in middle mediastinum.

* Functions :-

- 1- lubricated container for easy contraction of heart.
- 2- restrict excessive movement & over filling of heart.
- 3- protect & anchors the heart to the surroundings.

* Structure :-

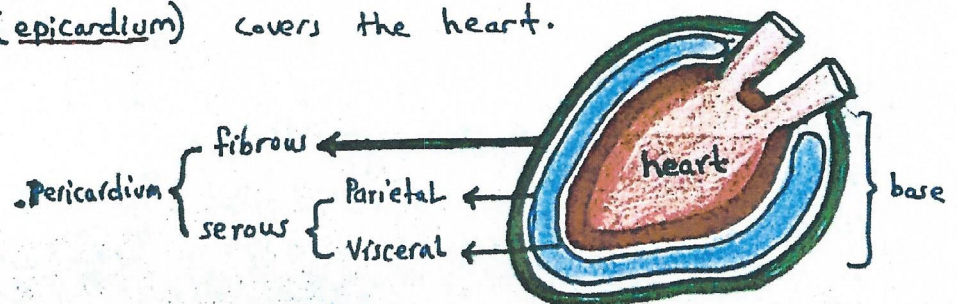
- Consists of 2 layers (fibrous & serous) :-

① Fibrous Pericardium :-

- shape :- conical sac made of strong fibrous tissue
 - It has apex, base & 2 surfaces (ant. & inf.)
- attachments :- below attached to central tendon of diaphragm.
 - anteriorly attached to sternum by sternopericardial ligaments
 - also it fuses with adventitia of big vessels (ascending aorta, IVC & pulmonary vessels). → (keeping these vessels mouth open)

② Serous Pericardium :-

- closed serous sac with slit like space (pericardial cavity) between two layers (visceral & parietal)
 - ↳ has small amount of fluid.
- (A) parietal layer :- lines the fibrous pericardium & reflected around roots of great vessels to be continuous w/ visceral layer.
- (B) visceral layer :- (epicardium) covers the heart.



* Nerve supply of Pericardium :-

1. Fibrous pericardium: & Parietal layer of serous P. → phrenic nerve and intercostal nerves. (sensitive).
2. Visceral layer of serous P. → like heart by autonomic nerve. sensitive to stretch & ischaemia. (angina transmitted by symp. nerves)

* Blood supply :-

- Internal thoracic artery (by pericardiophrenic & musculophrenic), thoracic aorta & bronchial arteries
- Veins drain into azygos system.

* Sinuses of serous pericardium :-

- they are recesses formed inside pericardial sac, includes :-

1. Transverse sinus :-

- transverse passage due to reflection of serous pericardium between → ascending aorta & pulm. trunk → anteriorly & SVC, left atrium & pulm. veins → posteriorly

2. Oblique sinus :-

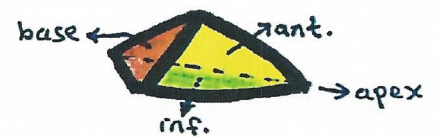
- a recess on posterior surface of heart, ^(behind left atrium) between the left atrium → anteriorly (front) and fibrous pericard. behind.
- Boundaries :- ant → Lt atrium (base of heart)
- post → fibrous pericardium. separating it from esophagus
descending aorta
- Rt side → IVC & 2 Rt pulm. veins.
- Lt side → the 2 Lt pulm. veins.

THE HEART

- A hollow muscular organ lies within the pericardium in the middle mediastinum.

* Shape :-

- pyramidal in shape, connected at its base to great blood vessels.
- has apex, base (post. surface) & 2 surfaces anterior (sternocostal) and inferior (diaphragmatic) surface. & 4 borders (Rt, Lt, sup. & inf.)



* functions :-

- acts as double pump with two functions :-

- 1) right side receives deoxygenated blood & then pumps it to lungs.
- 2) Left " " oxygenated " " " " " to body.

* Position :-

- the heart lies obliquely in the thorax, with its long axis passing downward & to the left.
- the right-sided chambers are mainly anterior to the left-sided one due to heart rotation during development.

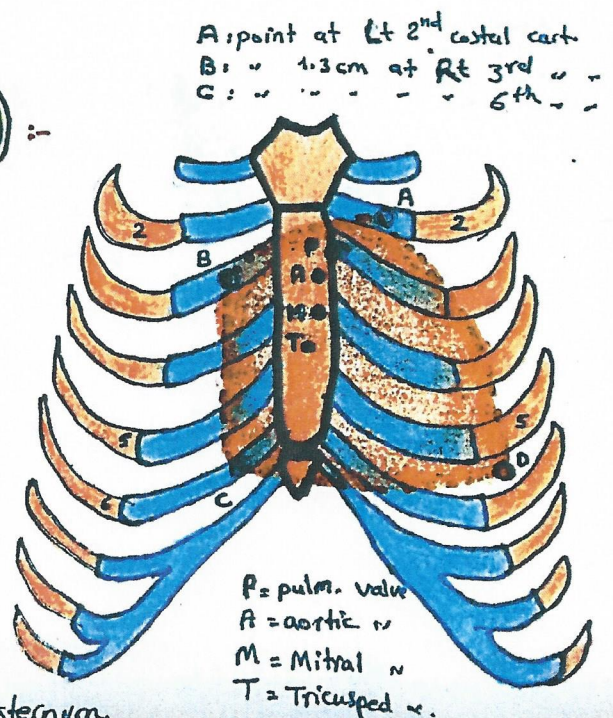
Borders of heart & surface anatomy :-

① superior border :-

- formed by roots of great vessels.
- extends from point ^A on 2nd Lt costal cart. about 1.3 cm from edge of sternum to a point ^B on 3rd Rt costal cart. 1.3 cm from edge of sternum.

② Right border :-

- formed by right atrium. → at Rt 3rd costal cart. 1.3 cm
- extend from Point ^B to Point ^C on Rt 6th costal cart. 1.3 cm from edge of sternum.



③ Inferior border :-

- formed by Rt ventricle & apical part of Lt ventricle.
- extends from point C "1.3 cm Rt 6th c.c." to a point D at the Left fifth intercostal space 9 cm (3.5 inches) from midline (the apex of heart)

apex of heart formed by Lt ventricle, present 9 cm at Lt 5th I.C. space.

④ Left border :-

- formed by Lt ventricle & left auricle.
- extends from point D (apex of heart) to point A 1.3 cm at Lt 2nd c.c.

Surface anatomy of heart valves :-

- Pulmonary valve: behind medial end of Lt 3rd costal cart. and adjoining part of sternum.
- Aortic valve: behind Lt half of sternum opposite 3rd intercostal space
- Mitral valve: " " " " " 4th costal cartilage
- Tricuspid valve: " middle " " 4th intercostal space.

Surfaces of heart :- 3 surfaces:-① Anterior (sternocostal) surface :-

- formed ~~mainly~~ by Rt atrium & Rt ventricle (separated by atriovent. groove) ^{mainly}

② Inferior (diaphragmatic) surface :-

- formed mainly by Rt ventricle (1/3) & Lt ventricle (2/3) separated by posterior interventricular groove. [also part of Rt atrium into w IVC opens]

③ Posterior surface (base) :-

- formed mainly by Lt atrium into which the 4 pulmonary veins opens.

NB :- the heart does not rest on its base, it rests on its diaphragmatic surface at central tendon of diaphragm

Internal structure of heart

- The cone-shaped heart is divided into 4 chambers (Rt & Lt atria, Rt & Lt ventricles)
- divided into Rt & Lt halves by a longitudinal septum, this septum lies obliquely so that Rt $\frac{1}{2}$ of heart lies anterior to the Rt while Lt half lies post. to the Lt
- the Rt $\frac{1}{2}$ receives & pumps deoxygenated blood while the Lt $\frac{1}{2}$ receives & pumps oxygenated blood.
- the heart is divided by a transverse septum (containing a valve) into
 - (a) post $\frac{1}{3}$ (toward base) the atrium (receiving chamber).
 - (b) ant $\frac{2}{3}$ (toward apex) the ventricles (pumping ").
- each atrium is connected to its corresponding ventricle by an opening called atrio-ventricular (A-V) opening which is guarded by an atrio-ventricular valve (tricuspid & mitral).

1. Rt atrium :-

- Position:- forms the Rt border (surface) of the heart.
- wall thickness:- 3 mm. its auricle lies in front & Rt to root of pulm. trunk
- Parts:- the interior of Rt atrium is divided into 2 parts:-
 - ① Anterior rough part:- (derived from ^{primitive atrium} atrium proper of embryo heart).
 - ② Posterior smooth " :- (" " Sinus venosus " " ").
 - the 2 parts separated from each other by a muscular ridge called crista terminalis which represented on outer surface by a depression called sulcus terminalis.
- ③ interatrial septum has a depression called fossa ovalis & ridge called annulus ovalis → discussed later.
- the ant. rough ^{& auricle} part formed of parallel ms called Musculi Pectinati
- opening of Rt atrium:-
 - ① Rt atrio-vent. orifice (tricuspid orifice)
 - ② SVC opening → in upper post. part, no valve.
 - ③ - IVC " → " lower post " , rudimentary valve
 - ④ Coronary sinus opening → bet. IVC & tricuspid orifice has a valve.
 - ⑤ opening of ant. cardiac vein & venae cordis minimi

2- Lt atrium :-

• Position:- behind & to the Lt of Rt atrium forming greater part of base of heart.

- it's auricle (Lt auricle) lies in front & to Lt of root of pulmonary trunk.

• Parts:- ①- anterior rough part & Lt auricle (derived from atrium proper) ^{musculi pectinati}
 ②- posterior smooth part (formed by incorporated pulmonary veins)
 ③- interatrial septum. → may represent a faint impression opposite to foramen ovale.

• Veins opening:- 4 pulm. veins (2 Rt & 2 Lt) opens into upper part of its post. wall also venae cordis minimi.
 - the Lt atrium has mitral orifice in Lt ventricle.

3- Rt ventricle :-

• Position:- forms 2/3 of anterior surface & 1/3 of inferior surface.
 - lies ant. to the Lt of Rt atrium. (ant & Rt to Lt ventricle)

• Wall thickness:- 9 mm.

• Cross section:- semilunar cavity in cross-section.

• Cavity:- formed of 2 parts:-

A- rough part (inflowing part).

B- smooth part (outflowing part).

- the line between 2 parts called supraventricular crest (extends from tricuspid to pulmonary orifice).

A- Rough part (inflowing):-

- lies below level of supraventricular crest.

- the wall is rough due to presence of:-

①- Trabeculae carneae:- coarse ms bundles (sponge-like)

②- papillary ms:- 3 conical ms (ant. & pos. & septal) having chordae tendinae attached to cusps of tricuspid valve.

- ant Papillary ms → from ant wall, sends chorda to ant & post cusps.

- post " " → " post " " " " post & septal "

- septal " " → " septum " " " septal & ant. "

NB: the post papillary ms is small muscle & the septal one is number of small muscles.

③ **Moderator band** (septo marginal trapecula) it is a muscular band crossing lumen of Rt ventricle covering the Right bundle branch (RBB) of AV bundle.

- function to transmit the ~~branch~~ of RBB & prevent over distension of Rt ventricle.

B. Smooth Part (outflowing) :-

- above the level of supravent. crest

- called infundibulum represents begining of pulmonary trunk.

4 Left ventricle :-

• **Position** :- - forms $\frac{1}{3}$ of ant. surface & $\frac{2}{3}$ of inf. surface

- lies post. to Lt of Rt ventricle (ant to Lt of Lt atrium).

• **Wall thickness** :- 27 mm (3 times Rt ventricle).

• **cross section** :- rounded.

• **cavity** :- formed of 2 parts :-

A. Smooth Part (outflowing) :-

- lies below aortic orifice, wall is formed of fibrous tissue instead of muscular tissue (to remain patent during systole).

- it is called aortic vestibule.

B. Rough part (inflowing) :-

① **trabeculae corni** :- as Rt ventricle but more numerous & fine

② **Papillary muscles** :- 2 large muscles (ant & post) sending the chordae tendinae to 2 cusps of mitral valve

- No moderator band.

Rt ventricle	Lt ventricle
9 mm thickness wall	27 mm
3 papillary muscles	two papillary ms.
has moderator band.	No.
Semilunar cut section	rounded (circular).
has tricusped valve $\bar{e}$ RA.	Mitral valve with LA.
has infundibulum (smooth area)	Vestibule (smooth area).
pumps deoxygenated blood into pulmonary trunk $\rightarrow$ Lungs	Pumps oxygenated bd to aorta $\rightarrow$ body.
forms most of anterior surface and inferior border	forms most of inferior super. and Lt border & apex

The wall of the heart

- The heart wall is composed of a thick layer of cardiac muscle " the myocardium , covered externally by epicardium (visceral layer of serous pericardium) & internally by endocardium .
- the three layers are richly supplied with blood vessels.
- Divided into 4 chambers by septum.
 - 1- two atria (Rt & Lt) , thin walls & divided by interatrial septum
 - 2- two ventricles (Rt & Lt) , thick walls & " " interventricular septum which is oblique septum.



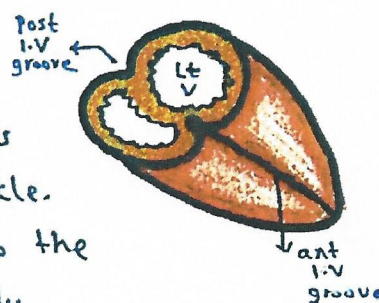
1- Interatrial septum:-

- Shows an oval depression called fossa ovalis above & to the Lt of IVC opening .
- the fossa ovalis is bounded above & on sided by a raised ridge called annulus ovalis .

NB:- fossa ovalis represents foramen ovale & septum primum of embryo
 - annulus ovalis " lower border of " secundum " "

2- Interventricular septum:-

- It is oblique in position being concave towards the Lt ventricle & convex towards Rt ventricle.
- It's ant. border & post. border corresponds to the ant. & post. interventricular groove respectively



- Parts are ① Muscular part : the lower large thick part.
- ② Membranous " :- " upper small oval area . → attached to fibrous skeleton.

NB:- the wall of Rt atrium is about 3 mm thickness.

"	"	"	Rt ventricle	"	"	9 mm	"	(3 times) ↗
"	"	"	Lt ventricle	"	"	27 mm	"	(3 times) ↗

Orifices & valves of heart

① Tricuspid orifice & valve :-

• Size :- admit tips of 3 fingers.

the tricuspid orifice (Rt atrioventricular orifice) is guarded by the tricuspid valve.

• structure of valve :- formed of  fibrous ring (directed forward & medially) 3 cusps.

① - the fibrous ring formed by the fibrous skeleton of heart.

② - the cusps are 3 (ant, post & septal) :- formed of two endothelial layers with a fibrous tissue layer in between

- the base of each cusp attached to fibrous ring.

- the free border attached to chordae tendinae of the papillary muscles.

② - Mitral orifice & valve :-

- the mitral orifice (Lt atrioventricular orifice) is guarded by the mitral (Bicuspid) valve.

• Size :- admit tips of 2 fingers.

• structure of valve :- formed of  fibrous ring (directed downward to the Lt) 2 cusps (ant & post).

- the ant. cusp is larger than the post.

- the free margin of each cusp receives chordae tendinae which are stronger than those of Rt. ventricle

③ Pulmonary orifice & valve :-

• Size :- 3 cm in diameter

- formed of 3 semilunar cusps (one post. & 2 ant.), the margin of each cusp is called lanule & has a thickening at its middle called nodule

- behind each cusp there is a space called sinus

Conducting system of heart

* Structure :-

- consists of modified (specialized) cardiac muscle fibers which are responsible for initiation & propagation [generation & conduction] of the cardiac impulse.

* Parts :-

① Sino atrial node (SAN) :- "Pacemaker" :-

- site → at upper part of sulcus terminalis of Rt atrium (ie post. border of crista terminalis) to the right of SVC opening.
- size → 1cm long & 3mm wide, crescentic shape.
- function → initiation of cardiac impulse then spread to the left atrium & to A-V node.

② Atrio-ventricular node (AVN) :-

- site → at lower part of atrial septum just above septal cusp of tricuspid valve (the only conduction between atrium & vent.)
- function → transmit impulse from atrium to ventricles

③ Atrio-vent. bundle (AVB) "bundle of His"

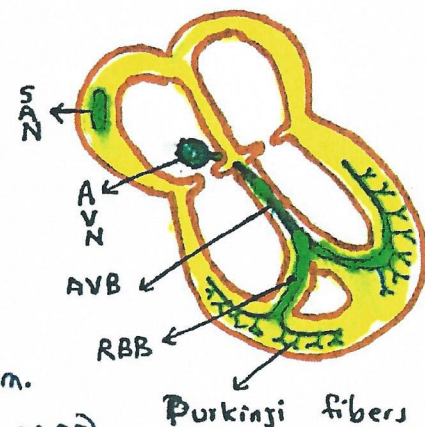
- site → behind septal cusp of tricuspid valve to reach membranous part of intervent. septum.
- at muscular part divide into two branches (RBB & LBB).

④ Right bundle branch (RBB) :-

- enters the moderator band to reach anterior wall of RV & becomes continuous with Purkinje fibers to supply RV.

⑤ Left bundle branch (LBB) :-

- Passes down beneath endocardium (inside muscular part of septum) to be dividing into Purkinje fibers distributed to all parts of Lt ventricle (LV).



* Blood supply :-

- SAN / AVN / AVB → by Rt coronary.
- LBB → by left & Rt "
- RBB → by left coronary.

Blood supply of heart

:- $\begin{cases} \text{arterial supply.} \\ \text{venous drainage.} \end{cases}$

- The arterial supply of heart is provided by the 2 coronary arteries (Rt & Lt) arising from ascending aorta, lying within Sub-epicardial conn. tissue.
- they form an arterial circle in A-V sulcus (coronary sulcus) like a crown (corona).

① Right coronary :-

• origin :-

- arises from anterior ^(Rt) aortic sinus of ascending aorta.

• Course :-

- runs forwards between right auricle & pulmonary trunk to reach the coronary sulcus (Rt atriovent. groove) then downward to reach inferior border of heart then backward to reach post. part of coronary sulcus.

• Termination :-

- ends by anastomosing with circumflex br. of left coronary artery.

• Branches :-

- 1- marginal artery :- to right ventricle. (along inf. border). ^(= acute marginal a.)
- 2- post. interventricular :- supply both ventricles, runs in post. I.V groove to anastomose with ant. I.V artery $\rightarrow$ & post $\frac{1}{3}$ of vent. septum.
- 3- small branches :- to Rt atrium including SAN, root of pulm. trunk & aorta.
- 4- anastomosing branches :- with circumflex br. of Lt coronary a.

[NB] the branch which supplies root of pulm. trunk called **conus** branch & it is the 1st branch.

- Post. I.V also called PDA = Post. descending artery
- ant. " " " LAD = Left anterior descending.

[NB] - anastomosis between coronary arteries are functional end arteries so not adequate if large artery is obstructed.

[NB] - the post I.V (PDA) is branch of Rt coronary in 90% of people "Rt dominance" but in 10% from Lt coronary "Lt dominance"

(2) Left coronary :-

• origin :-

- arises from Lt Posterior aortic sinus of ascending aorta.
- It is larger than Rt coronary but shorter (5-10 mm).

• Course :-

- runs forward between Lt auricle & pulm. trunk to reach the Lt atriovent. groove (coronary sinus) dividing into ant. I.V br. & circumflex.

• Branches :-

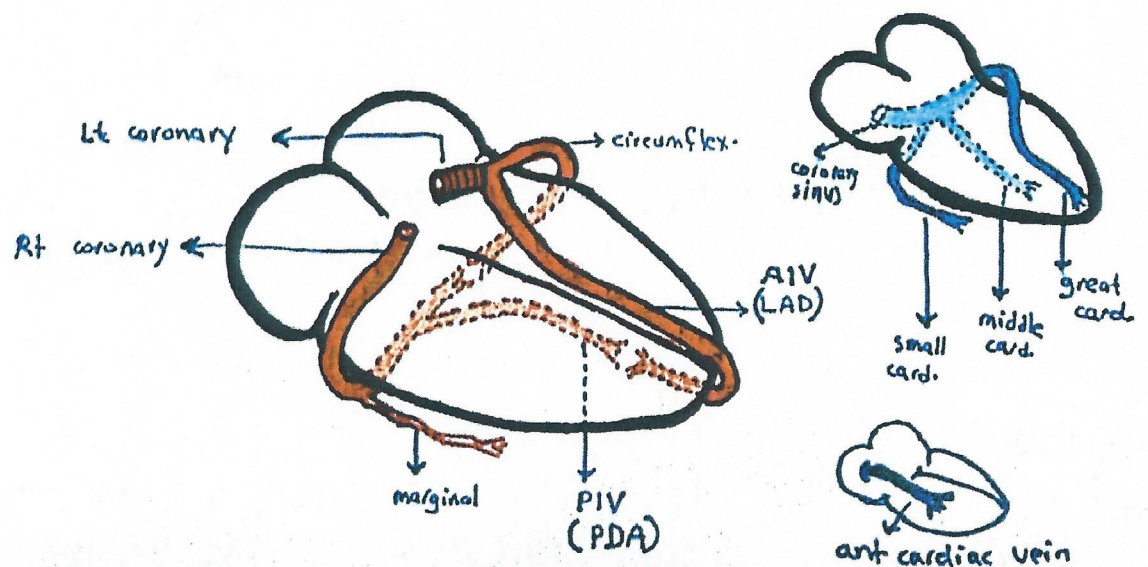
1. twigs to ascending aorta & pulm. trunk (→ conus branch), also give branches to SAN (SAN supplied mainly by Rt coronary).

2. Ant. I.V. artery :-

- also named LAD "Lt anterior descending".
- It is the larger of the 2 terminal branches (larger than circumflex).
- descend in intervent. (IV) groove then backward toward the post. I.V groove to anastomose with Post I.V. artery of Rt coronary.
- It supplies both ventricles + ant 2/3 of vent. septum.

3. Circumflex artery :-

- runs in Lt coronary sulcus under Lt auricle, then backward around Lt border of heart to reach post part of coronary sulcus & ends by anastomosing with Rt coronary a.
- It supplies Lt atrium, base of Lt ventricle.
- It gives marginal branch (obtuse marginal)



Venous drainage of heart :-

- most of the veins of heart accompany arteries.
- most of cardiac veins drain into coronary sinus.

*Coronary sinus :-

- Wide venous channel about 4 cm long draining most cardiac veins.
- site:- in post. part of coronary sulcus (bet. base & inf. surface).

End:- opens into Rt atrium above & Lt to I.V.C opening (has valve)

- Tributaries:-
- 1- great cardiac v.
 - 2- middle " "
 - 3- small " "
 - 4- oblique " "

① Great cardiac vein :-

- ascends in ant. I.V sulcus with LAD (ant. I.V. artery) then with circumflex artery to reach coronary sinus.

② Middle cardiac vein :-

- runs in post I.V sulcus with PDA (post I.V artery) to reach the coronary sinus.

③ Small cardiac vein:-

- runs with marginal artery ^{then with.} Rt coronary artery to reach the coronary sinus.

④ Oblique vein of Lt atrium:-

- small vein which descends obliquely on the back of Lt atrium to end in the coronary sinus.

*Veins which do not drain into coronary sinus :-

(Rt Vent)

① ant. cardiac veins :- 3-4 veins which drain ant. wall of RV draining into Rt atrium

② Venae cordis minimi :- are minute veins in walls of each chamber of heart & drain directly into the cavity of the chamber.

Nerve supply of heart :-

- the heart is supplied by autonomic (symp. & parasymp.) via the cardiac plexus of nerve (superficial & deep cardiac plexuses).

* function :-

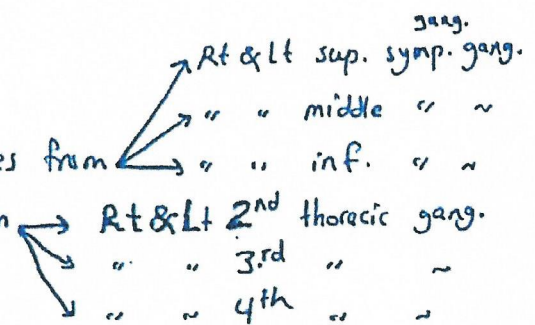
- ① - control rate & strength of heart beat. (symp. ↑, parasymp. ↓).
- ② - pain impulse (angina) conducted by afferent fibers with sympathetic.

NB :- autonomic nerves are not responsible for impulse initiation

* Origin of autonomic fibers :-

① - Sympathetic nerves :- (6 pairs of nerves)

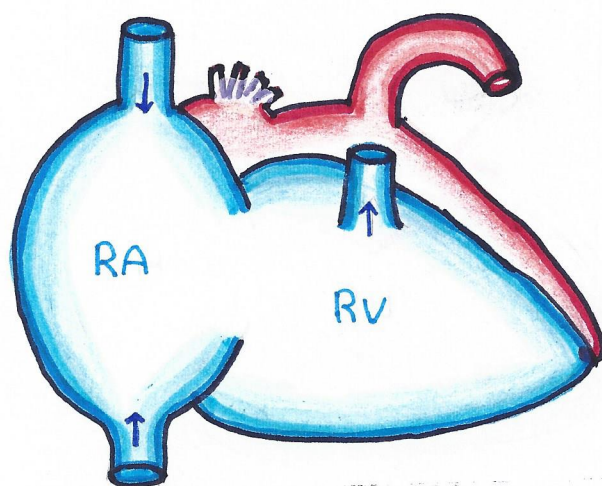
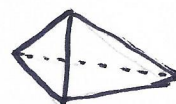
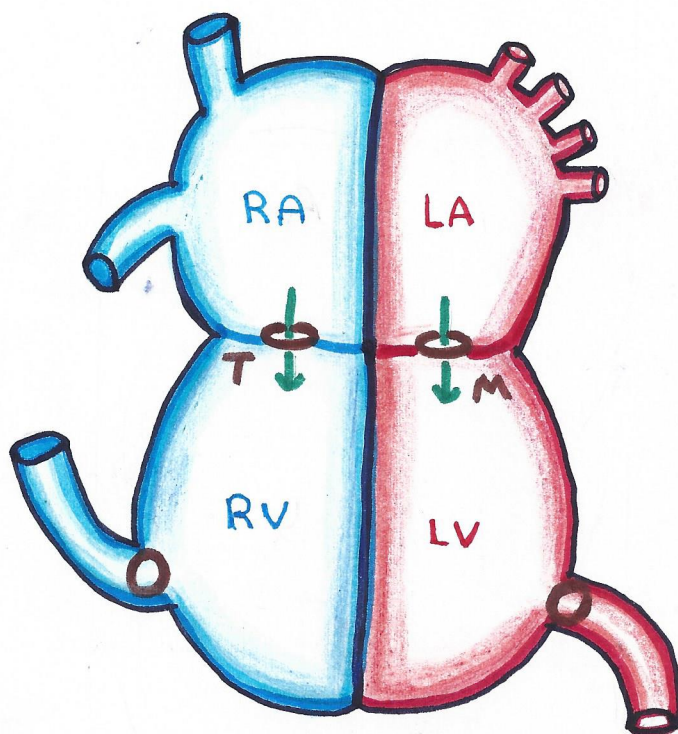
- in the neck 3 pairs of symp. branches from
- in the thorax " " " br. from

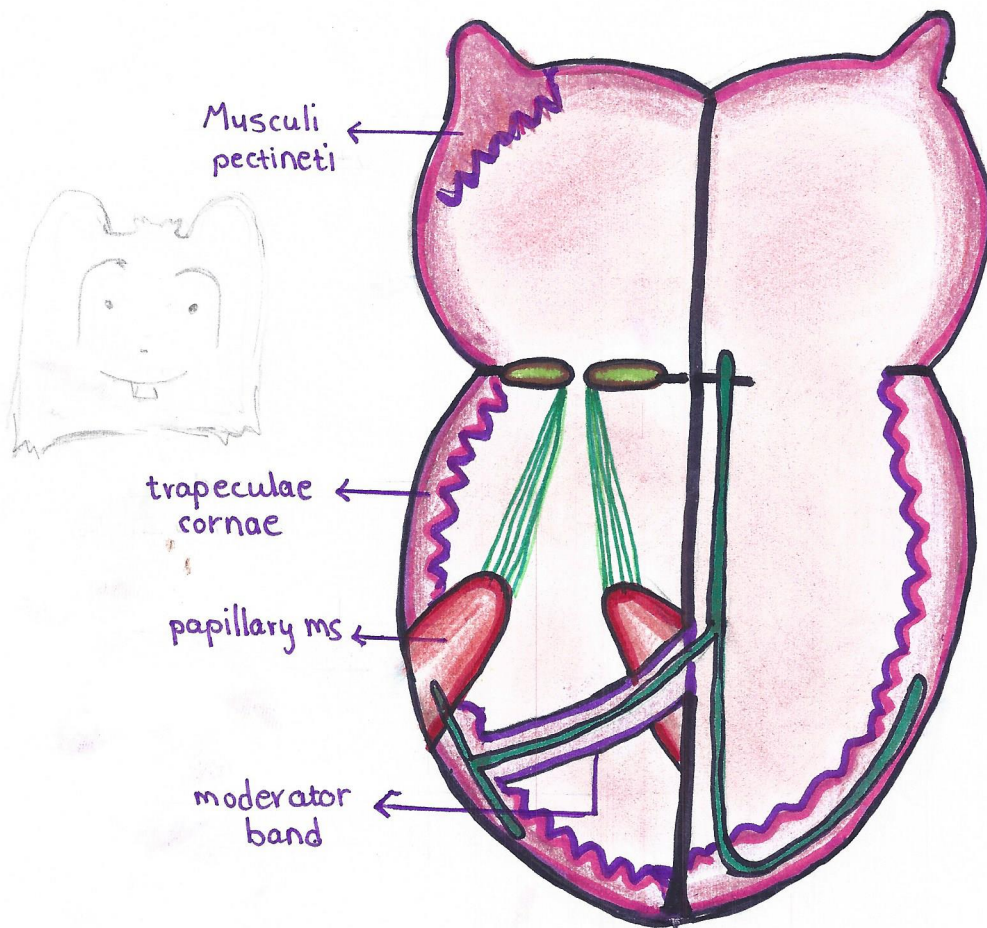


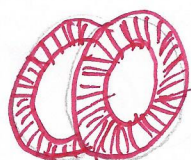
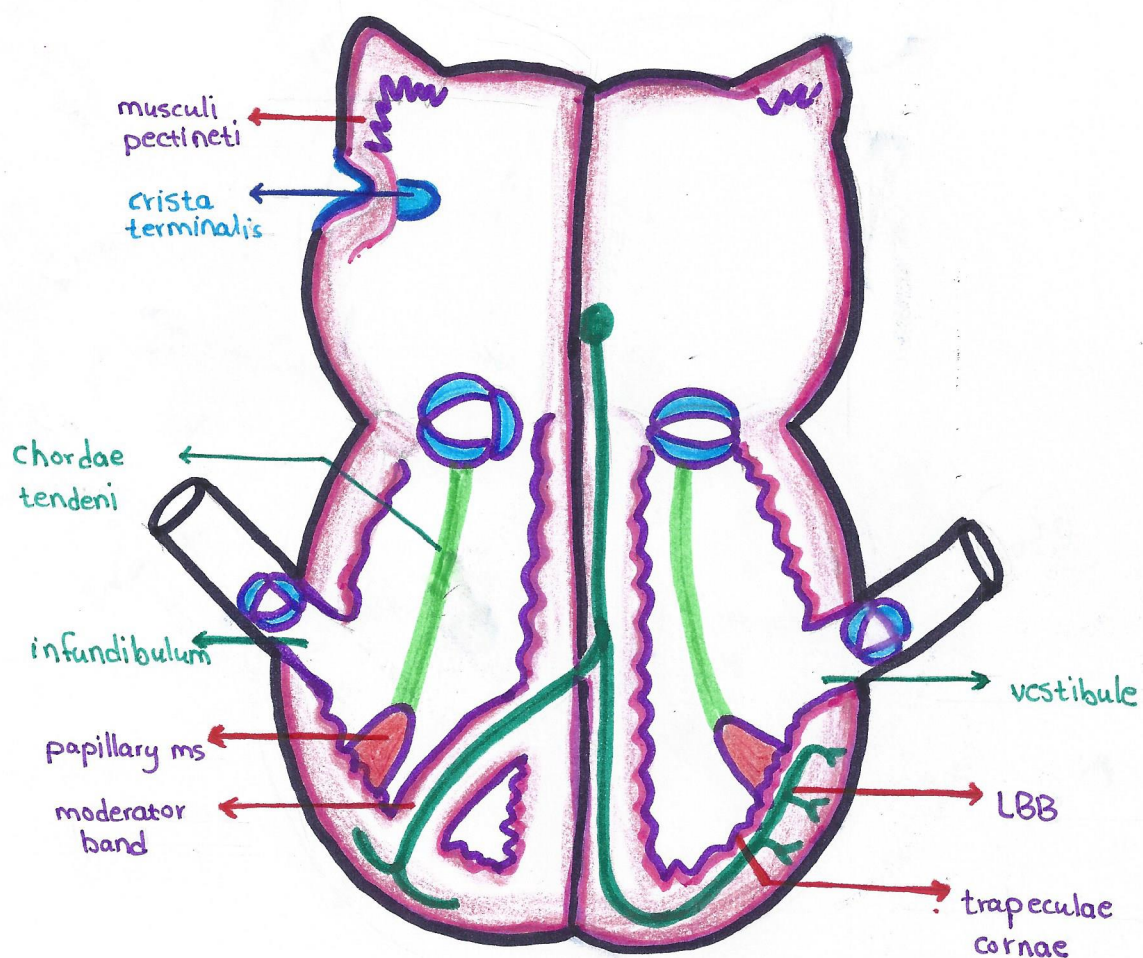
② - Parasymp. nerves :- (3 pairs) :-

- 2 pairs in the neck < Rt & Lt upper cervical cardiac br. (from R & L vagus).
- " " lower " " " (" " ").
- 1 pair in the thorax < Rt branch from Rt vagus;
- Lt " " Lt recurrent laryngeal N.

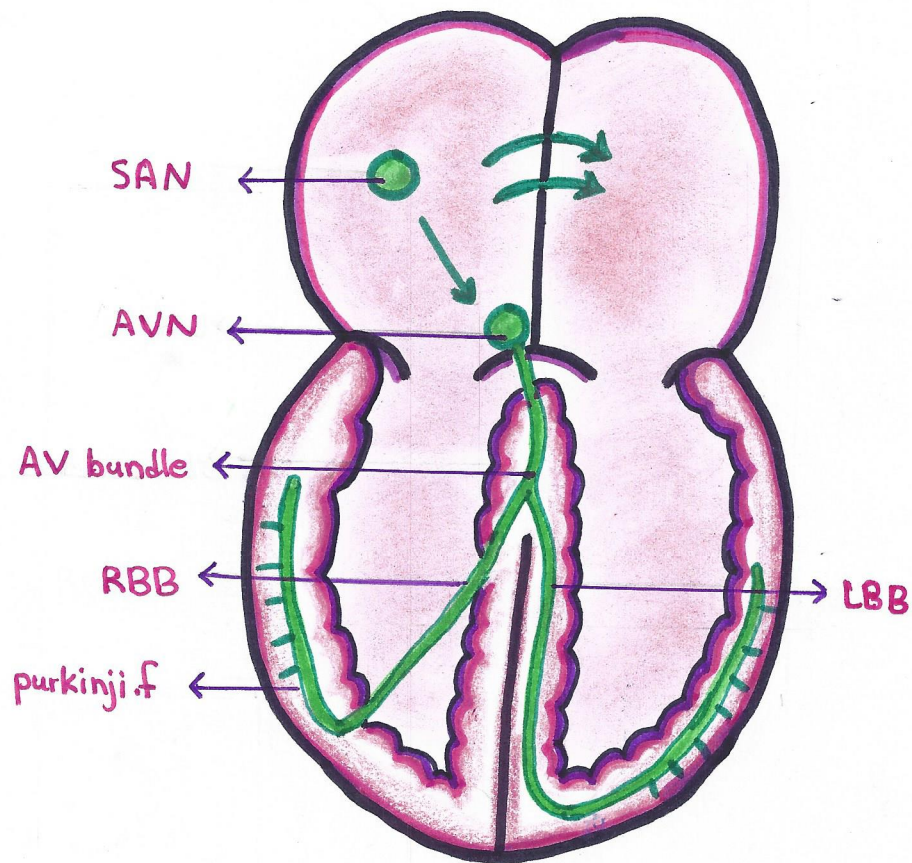
	Superf. cardiac plexus	deep cardiac plexus
Site	- below arch of aorta on Rt side of ligamentum arteriosum.	- in front of carina (tracheal bifur.) (deep to arch of aorta)
Formation	① Sup. cervical cardiac br. of Lt sym. chain ② inf. " " " Lt Vagus N.	① - receive from sup. cardiac plexus ② - all cardiac br. of 2 symp. chains & 2 vagi (except that of sup. plexus).
Branches	① - to Rt coronary plexus around Rt coronary → to heart. ② - to Lt ant. pulm. plexus in front of Lt bronchus. ③ - to deep cardiac plexus.	① - to Rt coronary plexus. ② - to Lt " " " ③ - to Rt ant. pulm. plexus. ④ - to Lt " " " ⑤ - br. to sup. cardiac plexus







RV LV



Tubes of thorax

I-Trachea :-

- A mobile cartilaginous & membranous tube of 13 cm (or 10-12 cm), long and 2.5_{cm} diameter
- Has a U shaped (or C shaped) bars of ^{16-20 rings} hyaline cartilage embedded in its wall to keep it patent.

* Beginning :-

- In the neck, below cricoid cartilage (at level of C₆ vertebra) about 5 cm above jugular notch.

* End :-

- In the thorax at level of sternal angle (lower border of T₄ vert.) by dividing into Rt & Lt main bronchi (slightly to Rt of midline).
- At deep inspiration, bifurcation of trachea (carina) may reach level of T₆ vertebra.
- It has 2 parts 1 cervical part (upper 1/2) lies in lower part of neck.
- 2 thoracic " (lower 1/2) " " sup. mediastinum.

* Blood supply :-

- = Arterial :- cervical part :- by inferior thyroid artery. Rt from 3rd Rt post. I.C.
- . thoracic part :- by bronchial arteries (descending aorta).
- = Venous :- cervical part :- drains into inf. thyroid vein.
- . thoracic part :- bronchial veins (azygos vein & hemiazygos)

* Lymphatic drainage :-

- pretracheal & paratracheal lymph nodes.

* Nerve supply :-

- autonomic fibers from

$\left\{ \begin{array}{l} \text{Rt \& Lt vagus. nerves.} \\ \text{Rt \& Lt sympathetic trunks} \\ \text{Rt \& Lt recurrent laryngeal nerves.} \end{array} \right.$

* Relations of trachea :-

	In the neck	In the thorax (from before backward)	
Anterior	- skin, jugular arch. - Sternothyroid & sternohyoid ms. - thyroid gland "isthmus". - inferior thyroid veins. - thyroid ima artery (if present)	- Sternum (manubrium). - Origin of sternothyroid & sternohyoid ms. - remnant of thymus gland. - Lt brachiocephalic vein. - aortic arch & origin of brachiocephalic & Lt common carotid artery	
Posterior	- Recurrent laryngeal N. (Rt & Lt) - esophagus. - vertebral column	- Lt recurrent laryngeal nerve. - esophagus. - vertebral column.	
Lateral	- Lobes of thyroid glands. - Carotid sheath.	Rt side	Lt side
		- Rt vagus nerve - Rt pleura & lung - Azygos vein. - brachiocephalic artery	- Lt vagus & phrenic N. - Lt pleura & lung. - Aortic arch, Lt CCA & Lt subclavian artery

CCA = common carotid artery

Applied anatomy :-

- Bronchoscopy :- is a method by which trachea & bronchi can be examined from inside.
 - Used as diagnostic & may therapeutic as removal of foreign body.
- Foreign bodies in trachea mostly fall into Rt bronchus (> 90%) because Rt bronchus is wider, shorter and more vertical than Lt one.

* Bronchi :-

- Trachea divided at level of sternal angle into Rt & Lt main (principle) bronchi :-

	Right main bronchus	Lt main bronchus
- length	1 inch (2.5 cm) "shorter"	2 inches (5 cm).
- width	wider / more vertical	narrower / more horizontal
- division	divides before entering hilum gives off sup. lobar bronchus (epiarterial) and hyparterial	divides on entering hilum of Lt lung into a superior & inferior lobar bronchus.
- course	passes under arch of azygos vein in front of esophagus	passes under arch of aorta in front of esophagus.
- Blood supply	- arterial :- Rt bronchial artery (from Rt 3rd post. I.C.A.) - venous :- into azygos vein	- arterial : 2 Lt bronchial (from descending aorta) - Venous : into hemiazygos (sup & inf)
- Nerve supply	- autonomic from ant. & posterior pulmonary plexus	- same as Rt.

- Rt bronchus is shorter, wider & more vertical than Lt.
- Lt " " longer, narrower & " horizontal " " .

II - Oesophagus :-

- A tubular structure about 25 cm (10 inches) long, ^{one of the} most narrow & muscular parts of digestive tube, Its lumen opens only during deglutition (swallowing).

* Beginning :-

- in the neck, at lower border of C₆ vertebra as continuation of the pharynx, descends in midline in front of vertebrae.

* Termination :-

- in the abdomen, immediately below esophageal opening of the diaphragm (opposite lower border of T₁₀) to join the stomach.

* Parts :-

- ① cervical part :- the upper 5 cm in lower part of neck.
- ② thoracic part :- longest part in sup. & post mediastinum.
- ③ abdominal part :- shortest 1.5 cm below diaphragm.

* Constrictions :-

- ① at its beginning (cervical constriction)
- ② where it is crossed by Lt main bronchus & aortic arch.
- ③ at lower end as it passes through diaphragm.

* Length :-

- length of esophagus is 25 cm (10 inches).
 - distance from incisors to stomach 45 cm. (to duodenum 55 - 65 cm)

⊖ distance from incisors to cervical constriction	15 cm.
⊖ " " " " Bronchoaortic constriction	25 cm.
⊖ " " " " diaphragmatic "	41 cm.

* Blood supply :-

- ① cervical part → from inf. thyroid artery, vein into inf. thyroid.
- ② thoracic part → from descending Th. aorta, vein azygos system.
- ③ abdominal " → " - left gastric artery, veins Lt gastric vein (from coeliac) (into portal vein)
 - also inf. phrenic.

* Lymphatic drainage :-

- upper
1/3 ① - cervical part → into deep cervical LN.
middle 1/3 ② - thoracic part → into superior & posterior mediastinal LN.
lower 1/3 ③ - abdominal part → into celiac LN.

* Nerve supply :-

- parasymp. → vagus nerve.
- sympathetic via the arteries.

* Relations :-

- In the neck
 - Anterior:- trachea & recurrent laryngeal nerves.
 - Posterior:- vertebral column.
 - laterally:- thyroid gland lobes.
- In the thorax
 - Anterior:- trachea, Lt recurrent laryngeal N., Lt main bronchus, pericardium (separates it from **LA** right atrium).
 - Posterior:- thoracic vertebrae, thoracic duct, azygos vein, Rt post. intercostal arteries & descending aorta at its lower end.
 - Laterally:- (Rt side) → mediastinal pleura, azygos vein (terminal part).
 - (Lt side) → mediastinal pleura, thoracic duct, aortic arch & Lt subclavian artery.

Nerves of thorax

Phrenic nerve :-

* Origin :- In the neck from C_{3,4,5} (ant. 1st rami) of cervical plexus mainly C₄. " it is mixed nerve (motor & sensory).

[NB] :- C₅ may descend separately forming accessory phrenic nerve which joins main phrenic at level of 1st rib or lung root

* Course & relations :-

- In the neck :- each phrenic descends on scalenus ant. ms deep to sternomastoid ms.
 - then enters the thorax passing deep to ^{beginning} innominate vein (Brachiocephalic vein).
- In the thorax :- each phrenic descends in superior mediastinum then middle mediastinum accompanied by pericardiophrenic vessels in front of root of lung.

Relations	Rt phrenic	Lt phrenic
Medially :-	- descends on the side of great veins i.e :- • Rt brachiocephalic • S.V.C. • pericardium of Rt atrium • I.V.C.	- descends on <u>left side</u> of following structures:- • Lt C.C.A & (<u>lt subclavian</u>). • arch of aorta & lt vagus • pericardium of the Lt ventricle
Laterally :-	- related to mediastinal surface of Rt pleura & lung. - leaves thorax through caval opening of diaphragm.	- related to mediastinal surface of Lt lung & pleura. - leaves thorax in special opening of Lt cupula of diaph.



* Branches :-

- Motor :- to diaphragm (only motor of diaphragm).
- sensor (3P) to pleura, pericardium & peritoneum (Parietal).
- Rt phrenic also supplies gall bladder ~~perito~~

Vagus nerve:

* origin :- It is the 10th cranial nerve (the longest cranial n.) arises from medulla.

- It is mixed n. (motor, sensory & parasympathetic), it is the most important parasymp. in the body [gives parasy. to respiratory tube, digestive tube & glands from esophagus to Lt colic flexure & heart (atria).] "so called vagus = vague"
(head → neck → thorax → abdomen)

* Course & relation :- (thoracic part) :-

- the vagi descend first in superior then post. mediastinum

Rt vagus	Lt vagus.
- descends in thorax posterolateral to brachiocephalic artery then lateral to trachea & medial to azygos vein. - Passes <u>behind</u> root of Rt lung & assist in formation of pulmonary plexus - after leaving the plexus passes onto <u>post. surface</u> of esophagus forms part of esoph. plexus. - passes through esoph. opening of diaphragm to reach <u>post. surface</u> of stomach forming <u>post. gastric N.</u>	- descends in thorax between Lt CCA (common carotid a.) & Lt subclavian artery then crosses Lt side of aortic arch. - Passes <u>behind</u> root of Rt lung & assist in forming pulm. plexus - after leaving the plexus passes onto <u>ant. surface</u> of esoph. forming part of esoph. plexus - passes through esoph. opening to reach <u>ant. surface</u> of stomach where called ant gastric N.

* Branches :- (mainly parasymp.).

- ①- gastric branches :- ant. & post. gastric N. (continuation of Lt & Rt vagi ^{respectively} ↑).
 - ②- esophageal branches :- forming esoph. plexus (supply esoph. & pericardium).
 - ③- pulmonary branches :- to ant & post. pulm. plexuses.
 - ④- Cardiac branches :- to cardiac plexuses (arise in sup. mediastinum)
 - ⑤- Lt recurrent laryngeal nerve :- arise from Lt vagus in sup. mediast. crosses aortic arch, it hooks around lig. arteriosum & ascends in groove bet. trachea & esoph. (supply ms. of larynx except cricothyroid by ext. laryngeal N.)
motor
- NB** (Rt recurrent arise from Rt vagus in neck & hooks around Rt subclavian a.)

Sympathetic chain : "thoracic Part"

- each sympathetic chain enters the thorax by crossing in front of neck of first rib.
- continuous above with cervical part & below with lumbar parts of sympathetic chain.
- runs downward on heads of the ribs as the most laterally placed structures in the mediastinum.
- leaves the thorax on side of body of T12 vertebra by passing behind the medial arcuate lig.
- thoracic part carries 11 or 12 ganglia (the 1st thoracic ganglion may unite with inferior cervical ganglion forming stellate ganglion)

* Branches :-

① Communicating branches :- to all spinal nerve by 2 rami :-

= White rami communicans :- preganglionic symp. from spinal nerve to the ganglion.

= Grey rami comm. :- from ganglion to spinal N.
post gang.



distributed to Blood vessels & skin.

② upper 5 post-ganglionic to heart, lung, aorta, esophagus

③ lower 8 pre-ganglionic give splanchnic nerves as follow:-

= greater splanchnic n. :- from 5th, 6th, 7th & 8th ganglia.

= lesser " " " " 9th & 10th ganglia.

= least (lowest) splanchnic " " 12th ganglion.

Lymphatic drainage of thorax

A-LYMPH NODES :-

I - Thoracic wall :-

① Anterior axillary LN_s:-

- drain lymph from skin of front of trunk (above umbilicus).

② Posterior axillary LN_s:-

- drain lymph from back of trunk (above iliac crest.).

③ Internal thoracic LN_s (along int. thoracic vessels):-

- drain lymph from ant. part. of intercostal space.

④ posterior intercostal LN_s:- (near to heads of ribs):-

- drain lymph from post. part of intercostal space.

●→●→●→●→ (all the above drain into thoracic duct) ←●←●←●←●

II - Thoracic cavity :-

- the thoracic contents drain into 3 groups of L-Ns:-

① Superior mediastinal (brachiocephalic) LN :-

- Lies in sup. mediastinum along Lt brachiocephalic vein

- receives afferent from thymus, heart, pericardium & esophagus

- it sends efferent to → tracheobronchial, to → bronchomediastinal lymph trunk

② Posterior mediastinal LN:-

- Lies in post. mediastinum in relation to aorta.

- receives afferent from pericardium, esoph., diaphragm & upper surface of liver.

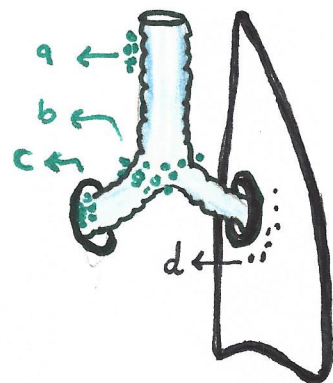
③ Tracheo-bronchial LN_s include:-

a. Paratracheal LN_s : along side of trachea.

b. tracheo-bronchial LN_s : at tracheal bifurcation

c. broncho-pulmonary LN_s : at hila of lung

d. Pulmonary LN_s : inside lung along major bronchial tree.



B-LYMPH VESSELS :-

I-Thoracic duct :-

* Beginning :-

- Commences at upper end of Cisterna chyli, on level of T₁₂ vertebra

* End :-

↳ 2 inches long, lies in front of upper 2 lumbar vertebra between 2 (aorta & azygos vein).

- drain at junction between Lt internal jugular vein & subclavian v.

* Course & relations :-

- enters thorax through aortic opening of diaphragm between

aorta & azygos vein → (to the Rt)
↳ (to the Lt)



in post. mediast

- It passes up & comes to lie against Rt side of esophagus. ↑

- At T₅ vertebra (sternal angle) it curves to the Left & passes behind the esophagus posterior to aorta & Lt subclavian vein in the superior mediastinum.

- Finally it passes vertically upward & arches forward across the dome of Lt pleura to enter the point of confluence of the Lt IJV & subclavian vein.

- Thoracic duct has many valves.

* Tributaries :-

- in addition to the tributaries of cisterna chyli, thoracic duct has :-

① Lt. jugular lymph trunk :-

- drains left side of head & neck (through ^{Lt.} deep cervical LN).

② Lt. subclavian trunk :-

- drains left upper limb (through Lt apical axillary LN).

③ Lt Broncho mediastinal trunk :-

- drains left side of thorax (by bronchomediastinal LN).

④ Lymphatics from post. intercostal LN.

II - Rt lymph. duct :-

:- receive lymph from upper Rt quadrant of body



- Short trunk (1 cm long), lies in root of neck.

- Formed by union of Rt jugular, Rt subclavian & Rt bronchomediast. trunks.

- ends at junction of Rt subclavian & Rt IJV vein.

LARGE VEINS OF THX

- ① Rt brachiocephalic vein. (Rt innominate) → one inch
- ② Lt " " " (Lt innominate). → 3 inches
- ③ Superior vena cava. (SVC) & (IVC). → 2 inches
- ④ pulmonary veins (2 Rt & 2 Lt).
- ⑤ azygos, superior & inf. hemiazygos → discussed in part I.

Rt Brachiocephalic vein :-

- Beginning :- formed at neck root behind Rt sternoclavicular joint by union of Rt subclavian & Rt int. jugular v.
- End :- behind Rt 1st costal cartilage by joining the Lt brachiocephalic vein to form SVC
- Tributaries :-

① Rt subclavian.
 ② Rt internal jugular vein.
 ③ Rt 1st posterior intercostal vein.
 ④ Rt vertebral vein.
 ⑤ Rt internal thoracic vein.
 ⑥ Rt lymphatic trunk.

(course)
 Runs downward
 vertical

Lt Brachiocephalic vein :-

- Beginning :- at neck root behind Lt sternoclav. j. by union of Lt subclavian & Lt IJV.
- End :- behind Rt 1st costal cartilage by joining the Rt brachiocephalic vein to form SVC.
- Course & relation :- passes obliquely downward & to Rt in front of aortic arch branches.

- Anterior :- manubrium sterni
 - Posterior :- aortic arch branches

{

Brachioceph.
 Lt CCA
 Lt subclavian
 thyroidea ima artery

Tributaries of Lt B.C :-

- ①- Lt subclavian vein.
- ②- Lt internal jugular.
- ③- Lt 1st post. intercostal vein.
- ④- Lt superior " "
- ⑤- Lt vertebral vein.
- ⑥- Lt internal thoracic vein
- ⑦- thoracic duct.
- ⑧- ~~the~~ inferior thyroid vein
- ⑨- thymic vein.

Superior Vena cava : (SVC) :-

- receives all venous blood above diaphragm.
- upper $\frac{1}{2}$ in superior mediastinum & lower $\frac{1}{2}$ in middle.
- **Beginning :-** behind Rt 1st costal cartilage (behind sternal end) by union of Rt & Lt brachioceph. (innominate) veins
- **End :-** - opposite Rt 3rd costal cartilage.
opens into Rt atrium
- **Tributaries :-** two brachioceph. veins & azygos (at level of 2nd costal cartilage).

Inf. vena cava - IVC - :-

- pierces central tendon of diaphragm opposite to 8th thoracic vertebra.
- Ends behind sternal end of Rt 6th costal cartilage opens into Rt atrium

LARGE ARTERIES OF THX

[A] :- Pulmonary trunk.

[B] :- Aorta.

A PULMONARY TRUNK ::

- It is 5 cm long & 3 cm wide.
- Conveys deoxygenated bd from RV to lungs.

• Beginning :- at pulmonary orifice (upper part of Rt ventricle) behind Lt 3rd sternocostal junction.

• End :- ends in concavity of aortic arch behind Lt 2nd costal cartilage divides into :-

- ① Rt pulm. artery :- runs to the Rt behind ascending aorta & SVC enters root of Rt lung.
- ② Lt pulm. artery :- runs to the Lt in front of descending aorta to enter root of Lt lung.

Ligamentum arteriosum :-

- Fibrous band connecting bifurcation of pulm. trunk to lower surface of aortic arch.
- It is a remnant of ductus arteriosus (w in fetus conducts blood from pulm. trunk to aorta bypassing lungs)
- following birth the ductus arteriosus closes if remains patent, surgical ligation necessary.
- Lt recurrent laryngeal nerve hooks around its lower border.

B

THORACIC AORTA

11

- Parts of aorta :- ① Ascending aorta.

② - arch of aorta.

③ descending thoracic aorta.

1

Ascending aorta.

- It is 5 cm long & 3 cm wide.

- Lies within fibrous pericardium.

At its root has 3 sinuses

- 1 anterior → anterior or (right)
- 2 posterior → posterior Lt or (left)
- posterior post or (post)

2 posterior $\rightarrow$ posterior Lt or (left)
 $\rightarrow$ posterior post or (post)

- Beginning :- at base (aortic orifice) of Lt ventricle opposite to Lt 3rd intercostal space (behind Lt 1/2 body of sternum)

- End :- behind Rt 2nd sternocostal junction where continues as arch of aorta.

- Branches :- ① Rt coronary A :- from anterior sinus (right).

②- Lt coronary A :- " post. Lt sinus (Lt).

• Course & relation:-

- runs upward & forward to lie behind Rt $\frac{1}{2}$ of sternum at level of sternal angle.

2

Arch of aorta

- Beginning :- continuation of ascending aorta. at the Rt 2nd sternocostal junction

- End:- continues as descending thoracic aorta at the lt side of lower border of T4 vertebra.

• Course & relation :-

- Lies behind manubrium sterni. arches upward, backward and to the Lt in front of trachea, then passes downward to the Lt of trachea.

①- Above (superior) :-

Lt brachiocephalic vein & arch branches (BC, LCC, LSC)

②- below (inferior) :-

- 1- bifurcation of pulmonary trunk.
- 2- Ligamentum arteriosum.
- 3- Lt recurrent laryngeal nerve.
- 4- Lt principal bronchus.
- 5- superficial cardiac plexus.

③- Anterior & to the Lt :-

- 1- Lt lung & pleura.
- 2- Lt vagus & phrenic.
- 3- Lt superior intercostal vein.
- 4- superior cervical cardiac branch of Lt symp. trunk.
- 5- inferior " " " " " vagus.

④- Posterior & to the Rt :-

- 1- Trachea & esophagus.
- 2- thoracic duct
- 3- Lt recurrent laryngeal nerve.
- 4- deep cardiac plexus

• Branches :-

arise from convex of aortic arch.

- ① Brachiocephalic :- passes upward to Rt of trachea behind Rt sternoclav. J. divide into RCC & RSC
- ② Lt common carotid (LCC) :- upward to Lt enters neck behind Lt Sternoclav. Joint
- ③ Lt subclavian artery (LSC) :- upward to Lt of trachea & esoph. arise behind Lt CC (arches over apex of Lt lung)
- ④ Thyroidea ima artery - occasionally present, may arise from brachiocephalic artery.

3 - Descending thoracic aorta :-

- Beginning :- continuation of aortic arch opposite sternal angle.
- At Lt side of lower border of T₄ vertebra.
- End :- continue as abdominal aorta at T₁₂ vertebra.
- Passes behind diaphragm through aortic opening
- Course & relation :- runs downward in post. mediastinum
inclining forward & medially to reach ant surface of vertebral column.
- Branches :-

- ① - Lower 9 post. intercostal arteries (from 3-11 spaces - 9 pairs).
- ② - subcostal arteries (one pair).
- ③ - Bronchial arteries (2 left) (1 right indirect).
- ④ - pericardial branches (~~few~~ small).
- ⑤ - oesophageal branches (4-5).
- ⑥ - phrenic branches (diaphragm) (one pair)

• **[NB]** :- Rt post. intercostal arteries are longer than Lt arteries & cross vertebral column.

THYMUS GLAND

- It is a primary lymphoid organ. (produce ^{thymic} T-lymphocytes)
- Shape :- flat, bilobed (no main hilum), Pink, lobulated.
- position :- between sternum & pericardium (ant. mediastinum)
 - extend up into superior mediastinum (front great vessels into ~~great~~ root of neck).
- Continue to grow until puberty later → involution.

* Blood supply :-

- Arteries : ① inferior thyroid artery. (Sometimes also superior)
- ② internal thoracic artery.
- Veins :- ① inferior thyroid vein.
- ② internal thoracic ~~artery~~ vein
- ③ - Lt brachiocephalic vein (main drainage)

* Lymph drainage :-

- No afferent lymphatics.
- Efferent to :- ① Brachiocephalic LN
- ② - Tracheobronchial.
- ③ - Parasternal.

* Nerve supply :-

- Sympathetic :- via stellate (cervico-thoracic) ganglion.
- parasymp. :- via vagus nerve.
- Sensory :- via phrenic, to capsule

* Relations :-

- anterior :- sternothyroid ms, sternohyoid ms, manubrium sterni
- posterior :- pericardium, (aortic arch), Trachea ^{Lt} & brachioceph. vein & it's branches

* Events at sternal angle :-

- 1- Second costal cartilage.
- 2- Disc between T₄-T₅ (lower border T₄).
- 3- Manubriosternal junction (angle of Louis).
- 4- Divides mediastinum into superior & inferior parts.
- 5- End of azygos arch into SVC.
- 6- End of ascending aorta.
- 7- Start & end of arch of aorta.
- 8- Start of descending aorta.
- 9- End of trachea (carina).
- 10- End of pulmonary trunk into 2 pulm. arteries.
- 11- thoracic duct curve to Lt side.
- 12- Cardiac plexus of nerves (superf. & deep).
- 13- Ligamentum arteriosum.
- 14- ~~hook~~ of Lt recurrent laryngeal nerve. around arch of aorta.
- 15- Skin above it supplied by supraclavicular but below it segmentally from T₂.
- 16- esoph - pushed to midline by aorta.

Notes on Part II

- **Pleura :-** is a thin membrane of fibrous tissue surfaced by a single layer of flat cells (mesothelium).
- it clothes each lung & lines thoracic cavity.
- **Pulmonary ligament :-** allows expansion of vessels in the lung root, especially inferior pulm. vein.
- **Suprapleural membrane :-** if damaged during dissection in the neck may lead to pneumothorax.
- **Healthy lung** is pink in colour, soft, spongy & elastic, it becomes dark & mottled due to inhalation of dust particles & smoke.
- **The heart wall** is composed of a thick layer of cardiac ms (myocardium) covered externally by the epicardium (visceral layer of serous pericard.) and internally by endocardium.
- **Mitral valve :-** normally admits the tips of two fingers, its anterior cusp is thicker than post. one.
- **The area of auscultation** for heart valves are not corresponding to surface marking of heart valves.

Fibrous skeleton of heart :-

- consists of 3 fibrous rings surrounding Atrioventricular, pulmonary & aortic orifices & are continuous with membranous part of interventricular septum.
- **function :-**
 - ① support (Anchors) the valves of the cusps.
 - ② prevents over dilatation of valves.
 - ③ blocks direct spread of electrical impulses from atria to ventricles.
 - ④ prevent overstretching of valve prevent incompetence

* Respiration :-

Types of respiration :-

- ① Abdominal :- as in children because the ribs are still horizontal, so the increase in thoracic capacity mainly by diaphragm.
- ② Thoracic type :- in adult female tend to depends mainly on ribs movement (male tend to use both but mainly abdominal type).

Mechanism of respiration :-

- Respiration consists of two phases, inspiration & expiration.
- Respiratory rate 14-16/minute.
- It accomplished by alternate $\uparrow$ & $\downarrow$ in capacity of the thoracic cavity by following mechanisms :-
 - ① contraction of diaphragm $\rightarrow \uparrow$ vertical diameter.
 - ② Raising ribs at their sternal end $\rightarrow \uparrow$ anteroposterior diameter & transverse diameter [by fixing 1st rib by contr. of scaleni ms & raising ribs by I.C. muscles].
 - ③ Relaxation of abdominal muscles for descend of the diaphragm.
 - It's contraction help in case of forced expiration.
 - ④ in Forced inspiration all muscles $\bar{w}$ can rise the ribs are involved (as sternomastoid, scalenus anterior and medius).
 - ⑤ in case of respiratory distress, scapula is fixed by trapezius, levator scapulae & rhomboids, so the serratus ant. & pectoralis minor can pull up the ribs. (Pect. major involved in certain position..